



Oxygen detected in atmosphere of Saturn's moon Dione

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Discovery could mean ingredients for life are abundant on icy space bodies

Los Alamos National Laboratory scientists and an international research team have announced discovery of molecular oxygen ions (O_2^+) in the upper-most atmosphere of Dione, one of the 62 known moons orbiting the ringed planet. The research appeared recently in *Geophysical Research Letters* and was made possible via instruments aboard NASA's Cassini spacecraft, which was launched in 1997.

Dione—discovered in 1684 by astronomer Giovanni Cassini (after whom the spacecraft was named)—orbits Saturn at roughly the same distance as our own moon orbits Earth. The tiny moon is a mere 700 miles wide and appears to be a thick, pockmarked layer of water ice surrounding a smaller rock core. As it orbits Saturn every 2.7 days, Dione is bombarded by charged particles (ions) emanating from Saturn's very strong

magnetosphere. These ions slam into the surface of Dione, displacing molecular oxygen ions into Dione's thin atmosphere through a process called sputtering.

Molecular oxygen ions are then stripped from Dione's exosphere by Saturn's strong magnetosphere.

A sensor aboard the Cassini spacecraft called the Cassini Plasma Spectrometer (CAPS) detected the oxygen ions in Dione's wake during a flyby of the moon in 2010. Los Alamos researchers Robert Tokar and Michelle Thomsen noted the presence of the oxygen ions.

"The concentration of oxygen in Dione's atmosphere is roughly similar to what you would find in Earth's atmosphere at an altitude of about 300 miles," Tokar said. "It's not enough to sustain life, but—together with similar observations of other moons around Saturn and Jupiter—these are definitive examples of a process by which a lot of oxygen can be produced in icy celestial bodies that are bombarded by charged particles or photons from the Sun or whatever light source happens to be nearby."

Perhaps even more exciting is the possibility that on a moon with subsurface water, such as Jupiter's moon Europa, molecular oxygen could combine with carbon in subsurface lakes to form the building blocks of life. Future missions to Europa could help unravel questions about that moon's habitability.

Two sensors aboard Cassini built by Los Alamos National Laboratory are expected to come into play beginning later this month, and again in April and May, when the Cassini spacecraft flies by the moon Enceladus. The moon is one of the brightest objects in our solar system, reflecting back nearly all of the sunlight that strikes it, thanks to a shimmering surface of snowy ice crystals. The moon also unleashes plumes of material from its south polar region. Los Alamos' ion-beam spectrometer and ion-mass spectrometer may help answer key questions about the composition of these plumes.

The research can be found at: <http://www.agu.org/journals/gl/gl1203/2011GL050452/>

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